FINAL PROJECT REPORT

Resource Utilization by Canada Geese at Rend Lake

Submitted by:

Cooperative Wildlife Research Laboratory
Southern Illinois University at Carbondale

Presented to:

Illinois Department of Conservation

January, 1987

Prepared by:

Thomas C. Tacha

Thomas C. Tacha, Waterfowl Ecologist
Cooperative Wildlife Research
Laboratory, SIU-C

Approved by:

W. D. Klimstra by

W. D. Klimstra, Director
Cooperative Wildlife Research
Laboratory, SIU-C

Digitized by the Internet Archive
in 2012 with funding from
CARLI: Consortium of Academic and Research Libraries in Illinois

http://archive.org/details/resourceutilizat00tach

TITLE: Resource Use by Canada Geese at Rend Lake

JUSTIFICATION:

Rend Lake Refuge is one of four refuges established in southern Illinois to help meet the wintering needs of the Mississippi Valley Population (MVP) of Canada geese (Branta canadensis) (Reeves et al. 1968, Paine 1985). Rend Lake and adjacent uplands have served as a wintering area for an increasing number of Canada geese since its establishment in 1970. Most of these geese are late migrants with arrival dates influenced by fall weather and habitat conditions at Horicon National Wildlife Refuge, Wisconsin (Paine 1985). In 1982, about 1/3 of the Canada geese wintering in southern Illinois were at Rend Lake (Thornburg and Estel 1983).

Rend Lake Refuge is a 2,024 ha inviolate portion of the 6,400 ha Rend Lake Wildlife Management Area managed primarily for Canada geese. It differs from other southern Illinois refuges in having less agricultural land for food production (Paine 1985). Refuge fields are sharecropped by area farmers, resulting in an excessive amounts of one crop planted in some years. Because of a large wintering goose population and relatively small area of cropland, the Refuge may contribute little to meeting energy needs of geese. Thus, privately owned agricultural fields may be important to meeting goose energy requirements. These issues suggested the need to study resource availability and use in the Rend Lake area.

Most of the information in this report was obtained by R. D. Pritchert for Project No. 22: Canada Goose Studies of the Cooperative Wildlife Research Laboratory. This final report encompasses 1 year of a project designed as a 2-year study. Because lack of funding resulted in premature

termination of contractual obligations, much of proposed data acquisition and analyses were not possible. D. F. Caithamer, R. J. Gates, and A. J. Moser provided assistance on the project.

OBJECTIVE 1:

To determine habitat availability and use by Canada geese in the Rend Lake area.

Methods

Goose habitat use was determined by surveys conducted two days per week along a 120 km census route representative of available habitat. Habitat availability within about 0.8 km of the route was inventoried and included representative land use up to 16 km from the refuge (Paine 1985:Fig 3). The route was driven three times per day so as to include the first three hours after sunrise, mid-day, and the three hours before sunset. Number of geese in each flock within 0.8 km of the route was estimated using a 15-60X spotting scope. Habitat type, time-of-day, field location and field size were recorded for each flock encountered.

Goose habitat use data were summarized for four seasonal periods: Early Fall (October 16-November 10), Late Fall (November 11-December 3), Early Winter (December 4-January 4), and Late Winter (January 5-February 15). Overall and seasonal means were calculated from the proportion of geese observed in corn, soybean, milo, winter wheat, alfalfa/clover, other forage, shallow wetland, and lake habitats, and the proportion of geese found on the Refuge. Application of analysis of variance permitted testing for significant variation ($\underline{P} < 0.05$) in habitat and Refuge use by season.

Based on Duncan's Multiple Range Tests, differences among means were identified.

Selectivity Indexes (SI) were calculated for all habitats during each seasonal period; SI = proportion of total goose use of a habitat divided by the proportion of that habitat available for use. A SI > 1.0 indicated a habitat was used in greater proportion than was available. Seasonal SI values were used to calculate a Mean Selectivity Index (MSI) for all seasons combined. Standard Z-tests were used to test for significant differences ($P < 0.05$) between goose use and availability of a habitat.

Results and Discussion

Habitat availability within 0.8 km of the Habitat Use Survey Route (Table 1) did not differ from availability within 16 km of Rend Lake Refuge. About 38% of both areas was forest, residential, or other land uses considered not available to geese. Usable habitats were dominated by grain cropland (51.2%) and forage cropland (27.3%); the remaining usable habitat was shallow wetland (subimpoundments) and lake. Grain cropland was nearly equally divided among corn, soybean, and milo, with only 3.2% in other crops (Table 1). Forage habitat was dominated by winter wheat (17.7%); the remainder was alfalfa/clover (4.2%) and other forage (5.4%).

Diurnal habitat use over the entire study period was highest in lake (33.5%), winter wheat (22.5%), and corn (16.8%) habitats. Use of soybean (10.5%), alfalfa clover (6.9%), and shallow wetland (6.0%) habitats was intermediate. Milo (3.5%) and other forage (0.3%) habitats were rarely used, while other crops were not observed to be used. All geese observed at night were roosting on lake or shallow wetland habitat.

Diurnal use of some habitats varied seasonally (Table 2). Soybeans were not used in early fall, but 11-20% of goose use was soybean habitat during the other seasons. Conversely, 13% of goose use in early fall was milo, but little or no use of milo was observed in other seasons. Use of alfalfa clover was also highest in early fall (16%), but use declined thereafter. Shallow wetland habitat received little or no use until late winter, while diurnal use of lake habitat increased from 13% in early fall to 34-45% in other seasons. Corn and winter wheat habitats were the most used cropland habitats; use did not vary among seasons.

Comparison of use and availability of habitats via selection indices (SI = % use/% availability) indicated selective use of some habitats by geese (Table 2). Over the entire study period geese used lake habitat more and milo less than their availability; all other habitats were used in proportion to availability. However, seasonal selection indices suggested goose use exceeded availability for alfalfa/clover in early fall, shallow wetlands in late winter, and lake habitat in all seasons except early fall.

Of geese observed during habitat use surveys, an average of 66% were using Rend Lake Refuge. The refuge occupies only 3.3% of the area usable by geese within 16 km of Rend Lake, suggesting a very strong attraction of the refuge for geese (SI = 20.0). Use of the refuge varied ($\underline{P} < 0.05$) seasonally, increasing from 61% in early fall to 94% in late fall and 84.8% in early winter, then declining to 43% in late winter.

Integration of goose habitat availability, use, and selection for the Rend Lake area suggests that, in general, all habitats used by geese

were available in adequate amounts within 16 km of Rend Lake. Lake was the only habitat used in higher proportion than availability throughout the October-February period when geese were present. This reflects the lake as a major feature attracting geese. The only habitat consistently underutilized (MSI < 1.0, $\underline{P} < 0.05$) was milo fields. For all practical purposes, geese were confined to Rend Lake Refuge during the goose hunting season. This confinement to the refuge is reflected in the 97% of observed use on the Refuge during the late fall study period, and to a lesser extent the 85% Refuge use in early winter. The percentage of geese seen on Rend Lake Refuge does not necessarily reflect actual percentage use of the refuge because nearly all of the refuge was surveyed but only a small portion of off-refuge area was surveyed via habitat use routes. Nevertheless, comparison of numbers of geese observed on survey routes with numbers of geese using the Rend Lake Area (from IDOC weekly aerial surveys) suggests that an average 80% of geese in the area were observed during habitat use surveys (see also Paine 1985). Thus, percentage use of Rend Lake Refuge may be overestimated, but only slightly. Concentration of goose use on the small land area of Rend Lake Refuge during the hunting season resulted in a decline in goose use of grain stubble fields from 38% in early fall to 29% in late fall.

OBJECTIVE 2:

To document time budgets for Canada geese using the Rend Lake area.

Methods

Flocks located along the habitat census route were also observed to estimate the proportion of geese engaged in each of six activities:

alert, locomotion, feeding, resting, comfort movements, and other (after Frederick and Klaas 1982). Activities of flocks noticeably disturbed by the observer were not recorded. To establish a 24-hour activity pattern, nocturnal roost activity was observed. Procedures for collecting roost activity data were similar to those used on the census route.

Total daily flight time was estimated by monitoring of radio-marked adult female geese two days per week. Monitoring began at sunrise with morning roost departure and ended with evening roost return. Five adult female geese were captured by rocket net in October, 1985 and marked with an individually identifiable neck collar and radio-transmitter. Additional radio-marked geese were monitored that moved to Rend Lake from bandings at Crab Orchard National Wildlife Refuge (NWR) and Horicon NWR. Geese were radio-marked at Crab Orchard NWR and Horicon NWR as part of the Ecology of Canada Geese project at SIU-C.

Diurnal activities of geese were summarized and compared using ANOVA by season and habitat. Diurnal and nocturnal activity data for all seasons combined were weighted by daylength and combined into an average diel (24 hour) activity budget.

Results and Discussion

Canada geese spent most of the day resting (38.3%), feeding (26.2) or in locomotor activities (19.3%), but these diurnal time allocations varied ($\underline{P} > 0.05$) seasonally (Table 3). The percentage of time spent resting increased from 25.9% in early fall and 22.2% in late fall to 51.5% in early winter, then declined to 37.2% in late winter. Feeding occupied

38.0% of the day during early fall, 27.6% in late fall, 16.7% in early winter, and 29.8% in late winter. Locomotion increased from 11.9% of time in early fall to 28.8% in late fall, then decreased to 17.2-19.6% of time in winter.

Diurnal time allocations also varied ($P > 0.05$) among habitats (Table 4). Percentage of time spent resting was much higher in shallow wetland (54.5%) and lake (49.4%) habitats than on land. Feeding occupied 41.9-60.8% of time when geese were in croplands, but only 13.0% in shallow wetland and 3.8% in lake habitat.

Diurnal radio-tracking indicated that geese spent an average of 7 minutes, 16 seconds of the day flying. Time in flight varied little among seasons, and no flight time was recorded at night.

Geese roosting on lake habitat at night spent over 82% of their time resting (Table 5). Most other nocturnal time was spent in comfort (8.5%) and locomoter (6.3%) activities.

Combining diurnal and nocturnal time budgets (Table 5) revealed that geese spent 63% of a 24-hour day resting. Feeding and comfort activities each accounted for about 12% of time.

OBJECTIVE 3:

To determine food requirements and availability of grain for Canada geese in the Rend Lake area.

Methods

Weights were obtained from geese captured on Rend Lake Refuge October 29, December 31, and February 10. Mean weights by age and sex

classes were combined into average weights of geese for each capture sample. These mean weights provided data needed to estimate daily high-energy food requirements of a goose as 10% of body weight using methods of Sincock (1963).

Goose-day-use (GDU) of the Rend Lake area was calculated based on weekly aerial counts conducted by the Illinois Department of Conservation. Midpoints between surveys were used to determine number of days multiplied by the appropriate count to derive goose days of use in continuous (approximately weekly) periods. Goose days of use for each period were summed to estimate total GDU for fall-winter 1985-86.

Availability of high energy grain in the Rend Lake area was based on estimates of hectares of corn, milo, and soybean fields within a 16 km radius of the Refuge, and waste grain available within samples of these fields (after Frederick et al. 1984). Cropland availability estimates were obtained from crop reporting data at Jefferson and Franklin County Agricultural Stabilization and Conservation Service offices.

Results and Discussion

Weights of Canada geese captured on Rend Lake Refuge declined from an average of 3,696 g on October 29 to 3,224 g on December 31 and 3,309 g on February 10 (Table 6). The overall mean weight of 3,276 g suggests that a goose at Rend Lake required an average of 328 g dry weight of high energy grain each day.

Results of aerial surveys suggested nearly 4.1 million GDU in the Rend Lake area between October 1 and February 15 (Table 7). Combining an estimated daily food requirement of 328 g of grain per bird with 4.1

million GDU suggests that geese in the Rend Lake area needed nearly 1.35 million kg of grain during the study period.

Estimates of waste grain in harvested fields indicated over 2.3 million kg of corn, 4.1 million kg of soybeans, and 1.4 million kg of milo were available immmediately after crop harvest within 16 km of Rend Lake during fall 1985. However, availability of corn declined 97% by the time geese departed in February 1986; soybeans declined 95% and milo 72% during the same period.

Rend Lake Refuge contained 70 ha of corn, 128 ha of soybeans, and 46 ha of milo during fall 1985. Applying waste grain estimates to the area devoted to these crops suggests that the refuge had about 11,000 kg of corn, 30,000 kg of soybeans, and 6,800 kg of milo available during fall.

High energy food in the form of waste grain in stubble fields appeared to be available in adequate supply within 16 km of Rend Lake to meet requirements of 4.1 million GDU observed during the study period. The 1.35 million kg of grain required by geese was available during fall when corn stubble fields contained over 2.3 million kg of corn and soybean stubble fields contained over 4 million kg of soybeans. Milo stubble fields were rarely used by geese and probably contributed little to their food consumption.

The 13% decline in average goose weight between October 29 and December 31 is not surprising given the restricted movements of geese during the hunting season in late fall and early winter, and the associated declines in feeding time and use of grain stubble fields. Rend Lake Refuge supplied only

244 ha of grain fields containing about 48,000 kg of grain. The Refuge received an estimated 300,000 days of goose use during the late fall study period. These geese would have required over 98,000 kg of grain, over twice the estimated grain availability on the Refuge.

Crop harvest chronology also affected availability of grain on Rend Lake Refuge during late fall-early winter. In 1985-86, little or no corn was harvested prior to the close of hunting. Although geese fed in standing corn at Rend Lake Refuge, the late corn harvest resulted in reduced availability of corn when it was most needed.

GENERAL DISCUSSION AND CONCLUSIONS

Habitats necessary for feeding and resting appear available in adequate amounts for the numbers of Canada geese currently using the Rend Lake area. Milo stubble was the only major habitat type consistantly underused by geese, and milo contributed little to goose needs. Availability of high energy foods in the form of waste grain also appeared adequate to meet energy needs of current numbers of geese using the area.

The hunting season caused limited off-refuge movement by geese that resulted in significant declines in feeding time and use of grain stubble fields during late fall and early winter. The small land area combined with current land use on Rend Lake Refuge cannot support the high energy food requirements of goose use during the hunting season. A 13% decline in weights of geese between October and December was consistant with inadequate availability of high energy waste grain during the hunting season. Weight losses were not observed during the same period at Union County Conservation Area or at Horicon NWR (Unpubl. data, CWRL - SIUC),

suggesting that the small land area and/or land use at Rend Lake Refuge combined to cause the observed weight loss.

The capacity to improve habitat conditions for Canada geese in the Rend Lake area is for the most part limited to increasing the land area and/or improving land use on Rend Lake Refuge, and to a lesser extent improving land use on lands administered by the Army Corps of Engineers. Additional research is needed to provide an adequate data base for specific habitat management recommendations.

LITERATURE CITED

Frederick, R B. and E. E. Klaas. 1982. Resource utilization and behavior of migrating snow geese. J. Wildl. Manage. 46:601-614.

Frederick, R. B., E. E. Klaas, G. A. Baldasarre, and K. J. Reinecke. 1984. A method for sampling waste corn. J. Wildl. Manage. 48:298-303.

Paine, C. R. 1985. Habitat use, movements and harvest of Canada geese associated with Rend Lake, Illinois. M.A. Thesis. Southern Illinois University, Carbondale. 82pp.

Reeves, H. M., H. H. Dill, and A. S. Hawkins. 1968. A case study in Canada goose management: the Mississippi Valley Population. Pages 150-165 in R. L. Hine and C. Schoenfeld eds. Canada goose management. The Student Chapter of The Wildl. Soc. Stevens Point, WI. 195pp.

Sincock, J. L. 1963. Estimating consumption of food by wintering waterfowl populations. Proc. Southeast Assoc. Game and Fish Comm. 16:217-221.

Thornburg, D. and B. Estel. 1983. Canada goose harvest and hunter activity in southern Illinois quota zone during 1981 season. Ill. Dept. of Conserv. Mig. Bird. Sec. Periodic Rep. 37.

Table 1. Habitat composition as observed from the survey route during fall and winter 1985 - 86 at Rend Lake, Illinois. Forest, residential, and other habitats considered not usable by geese are not included in analyses.

Habitat	Hectares	%[a]
Corn	1178	18.7
Soybean	953	15.1
Milo	896	14.2
Winter Wheat	1111	17.7
Alfalfa/Clover	266	4.2
Other Forage	338	5.4
Other Crop	200	3.2
Shallow Wetland	307	4.9
Lake	1043	16.6
Total	6292	100.0

[a]Not different from habitat distribution within 16 km of Rend Lake as determined from records at the Franklin, Jefferson, and Williamson County offices of the Agricultural Stabilization and Conservation Service.

Table 2. Percent habitat use, habitat Selectivity Index (SI), and Mean Selectivity Index (MSI) from 91 surveys of geese using the Rend Lake area, Illinois during fall and winter 1985-86.

Habitat[a]	Season				Overall % Use MSI
	Early Fall	Late Fall	Early Winter	Late Winter	
Corn	25 (9) A[b]	9 (3) A	15 (5) A	17 (4) A	16.8
	1.35	0.50	0.82	0.89	0.89
Soybean	0 (0) B	20 (7) A	11 (3) A	11 (3) A	10.5
	0.00	1.30	0.78	0.78	0.72
Milo	13 (7) A	0 (0) B	0 (0) B	2 (2) B	3.5
	0.93	0.00	0.00[c]	0.18	0.28[c]
Winter Wheat	33 (7) A	22 (4) A	23 (6) A	17 (3) A	22.5
	1.84	1.26	1.26	0.99	1.34
Alfalfa/Clover	16 (7) A	11 (4) AB	5 (2) B	2 (1) B	6.9
	3.88	2.57	1.24	0.05	2.05
Other Forage	0 (0) B	0 (0) B	0 (0) B	1 (0) A	0.3
	0.00	0.00	0.00	0.11	0.03[b]
Shallow Wetland	0 (0) B	0 (0) B	1 (1) B	16 (3) A	6.0
	0.00	0.00	0.12	3.18[c]	0.82
Lake	13 (7) B	38 (8) A	45 (6) A	34 (5) A	33.5
	0.77	2.26[c]	2.68[c]	2.03[c]	1.94[c]

[a]Geese were not observed in the Other Grain habitat.

[b]Mean percent habitat use = 25, SE = (9), Duncan's Multiple Range Test result = A (seasons with significant difference in mean habitat use have different letters), and habitat Selectivity Index (SI) = 1.35.

[c]Indicates significant habitat selection ($P < 0.05$).

Table 3. Seasonal changes in mean (±SE, N = 1,013 observations) percentage of diurnal time spent in various activities by Canada geese in the Rend Lake area during fall and winter, 1985-86.

Activity	Season				Seasons Combined
	Early Fall	Late Fall	Early Winter	Late Winter	
Alert	15.4(1.3)A	10.4(0.8)B	4.5(0.3)D	8.2(0.5)C	8.0
Comfort	5.3(8.5)B	10.2(1.1)A	6.4(0.5)B	5.9(0.5)B	6.6
Feed	38.0(3.5)A	27.6(2.4)B	16.7(1.7)C	29.8(1.5)B	26.2
Locomotion	11.9(2.4)C	28.8(3.0)A	19.6(1.9)B	17.2(1.3)B	19.3
Rest	25.9(3.3)C	22.2(2.0)C	51.5(2.1)A	37.2(1.5)B	38.3
Other	3.5(1.2)A	0.8(0.2)B	1.1(0.2)B	1.7(0.4)B	1.6
Total	100.0	100.0	100.0	100.0	100.0

[a]Results of Duncan's Multiple Range Test; different letters within rows denote significant ($P < 0.05$) differences among seasons.

Table 4. Differences among habitats in mean(±SE) percentage of diurnal time spent by Canada geese in various activities on and near Rend Lake during fall and winter, 1985-86.

Habitat	Activity						Total
	Alert	Comfort	Feed	Locomotion	Rest	Other	
Corn	15.4(1.3)A[a]	2.7(0.5)B	56.9(2.6)	10.0(1.6)B	13.4(2.1)B	1.6(0.6)A	100.0
Soybean	8.7(0.6)B	6.3(0.9)A	41.9(2.8)B	8.3(1.0)B	33.2(2.7)B	1.6(0.5)A	100.0
Milo	13.7(2.7)A	1.3(0.4)B	59.5(7.6)A	5.4(1.7)B	18.8(7.8)B	1.3(0.6)A	100.0
Winter Wheat	11.6(0.7)A	6.4(0.8)A	44.0(2.2)B	7.6(1.2)B	29.0(2.0)B	1.4(0.4)A	100.0
Alfalfa/Clover	13.4(1.7)A	6.3(1.3)A	47.8(4.7)B	3.8(1.0)B	26.6(4.4)B	2.1(1.1)A	100.0
Other Forage	14.4(3.1)A	0.6(0.3)B	60.8(9.2)A	5.5(4.1)B	18.2(7.4)B	0.6(0.4)A	100.0
Shallow Wetland	5.0(1.1)C	9.5(1.5)A	13.0(2.5)C	17.2(2.8)B	54.5(3.4)A	0.9(0.4)A	100.0
Lake	4.1(0.4)C	7.5(0.6)A	3.8(0.6)C	33.5(1.9)A	49.4(1.8)A	1.7(0.4)A	100.0

[a]Results of Duncan's Multiple Range Tests; different letters within columns denote significant ($P < 0.05$) differences among habitats.

Table 5. Average percentage diurnal, nocturnal, and diel time allocations of Canada geese in the Rend Lake area during fall and winter, 1985-86.

Activity	Diurnal	Nocturnal	Diel[a]
Alert	8.0	1.4	4.4
Comfort	6.6	8.5	7.6
Feed	26.2	0.0	12.0
Locomotion	19.3	6.3	12.3
Rest	38.3	82.3	62.2
Other	1.6	1.5	1.5
Total	100.0	100.0	100.0

[a]Weighted average of diurnal and nocturnal time allocations using an average October-February daylength of 11 hours.

Table 6. Mean (±SE) weights of Canada geese captured at Rend Lake during fall and winter, 1985-86.

Date/N	Age	Sex	Weight
October 29			
5	Adult	Female	3695(85)
6	Adult	Male	4067(167)
2	Juvenile	Female	3350(90)
2	Juvenile	Male	3580(40)
	Weighted Average[a]		3696
December 31			
4	Adult	Female	3022(105)
2	Adult	Male	3570(70)
7	Juvenile	Female	2828(110)
8	Juvenile	Male	3388(58)
	Weighted Average		3224
February 10			
7	Adult	Female	3229(93)
11	Adult	Male	3746(105)
6	Juvenile	Female	2790(51)
6	Juvenile	Male	3360(145)
	Weighted Average		3309
Total			
66	$\bar{x}$ Weighted Average		3276

[a]Weighted by proportions of each age/sex class in entire sample of 66 geese to standardize variability associated with small samples on each date.

Table 7. Aerial counts from periodic goose inventories conducted by the Illinois Department of Conservation and goose-day-use in the Rend Lake area October - February, 1985-86.

Count Date	No. of Geese	Period of Use	Goose-day-use
October 15	2,500	Oct 1-21	52,500
October 28	6,500	Oct 22-31	65,000
November 4	6,500	Nov 1-12	78,000
November 20	8,000	Nov 13-26	112,000
December 2	18,000	Nov 27-Dec 5	180,000
December 9	70,000	Dec 6-13	560,000
December 16	60,000	Dec 14-27	840,000
January 7	65,000	Dec 28-Jan 10	910,000
January 13	65,000	Jan 11-17	455,000
January 21	36,000	Jan 18-24	252,000
January 27	27,000	Jan 25-Feb 15	594,000
TOTAL		Oct 1-Feb 15	4,098,500

Table 8. Availability of waste grain within 16 km of Rend Lake immediately after harvest in fall 1985, and after geese departed in 1986.

Grain	Fall		February		% decline
	kg/ha $\bar{x}$(±Se)	kg in area[a]	kg/ha $\bar{x}$(±SE)	kg in area[a]	
Corn	158(52)	2,328,000	4(2)	59,000	97
Soybean	233(100)	4,113,000	12(7)	212,000	95
Milo	147(84)	1,423,000	42(13)	397,000	72

[a]Based on data from Franklin and Jefferson county ASCS offices indicating 14,738 ha of corn, 17,653 ha of soybean, and 9,682 ha of milo planted within 16 km of Rend Lake, and $\bar{x}$ kg/ha of waste grain in each grain habitat type.